*Geometry EXTRA CREDIT! *

Name: _____

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MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose, but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

DO YOUR FIGURING HERE.

1. If $a = 3$, $b = 5$, and $c = 2$, what is the value of $abc + \frac{ab}{b-c} + c$?

   A. 15
   B. 17
   C. 35
   D. 37
   E. 127

2. $|33 - 7| - |7 - 33| = ?$

   F. 0
   G. 14
   H. 52
   J. 66
   K. 80

3. The public library charges 5¢ per day for an overdue book and 10¢ per day for an overdue magazine. When Jed returned library materials that were 1 day late, he was charged 35¢. How many of the overdue materials that Jed returned were magazines?

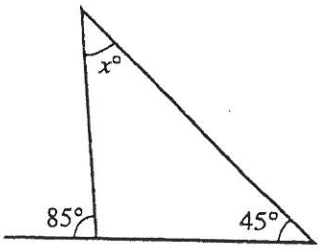
   A. 0
   B. 1
   C. 2
   D. 3
   E. Cannot be determined from the given information

4. The sum of $(2h - 2)$, $(3h - 1)$, $(h + 2)$, $(h + 5)$, and $(3h + 1)$ is equivalent to:

   F. $8h - 11$
   G. $8h + 11$
   H. $8h + 5$
   J. $10h + 5$
   K. $10h + 11$

DO YOUR FIGURING HERE.

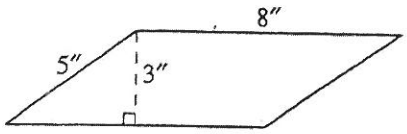
5. A triangle has one interior angle that has measure 45°, another interior angle that has measure $x°$, and an exterior angle that has measure 85°, as shown below. What is the value of x ?



A. 85
B. 80
C. 50
D. 45
E. 40

PPF 5C1

6. What is the perimeter, in inches, of the parallelogram shown below?



MEA 503

F. 13
G. 16
H. 24
J. 26
K. 40

7. What is $x^2 - 2xy + 3$ if $x = 2$?

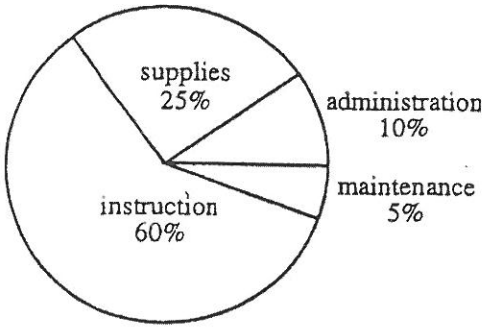
A. -3
B. -1
C. $4 - 4y$
D. $5 - 4y$
E. $7 - 4y$

8. If $3(2x + 1) - 5 = 7$, what is the value of x ?

F. $\frac{11}{2}$
G. $\frac{5}{2}$
H. $\frac{11}{6}$
J. $\frac{3}{2}$
K. $\frac{2}{3}$

DO YOUR FIGURING HERE.

9. The pie chart below shows how a school district's funds were spent both last year and this year. The district spent \$4,200,000 last year and \$5,000,000 this year. How much money was spent on instruction for these 2 years combined?



A. \$2,520,000
B. \$3,000,000
C. \$3,680,000
D. \$5,520,000
E. \$9,200,000

10. The function $f(x)$ is defined as $f(x) = 3x^2 - 5$ for all real numbers x. What is $f(-4)$?

F. −149
G. −53
H. −29
J. 43
K. 139

11. The table below shows the results of Phone First's poll of a random sample of 1,000 of their 25,000 customers regarding the quality of service they have received. If the results of the 1,000 customers polled are representative of all 25,000 customers, which of the following is the best estimate of how many of Phone First's 25,000 customers feel they receive "Excellent" service?

Poll result	Number of customers
Excellent	610
Good	272
Fair	106
Poor	12
Total	1,000

A. 610
B. 6,800
C. 9,750
D. 15,250
E. 15,984

DO YOUR FIGURING HERE.

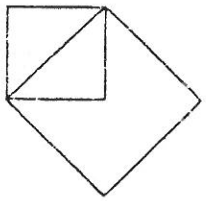
12. For all real numbers a, b, c, and d, which of the following is an equivalent form of $ba + cd$?

F. $ac + db$
G. $bd + ca$
H. $bc + ad$
J. $da + cb$
K. $dc + ba$

13. Which of the following is a correct factorization of $x^3 - y^2x$?

A. $(x^2 - y)(x + y)$
B. $(x^2 - y^2)(x + y)$
C. $x(x - y)(x + y)$
D. $y(x + y)(x - y)$
E. $x^2(x - y)$

14. The diagonal of a smaller square is a side of a larger square, as shown below. The area of the smaller square is 36 square centimeters. What is the area of the larger square, in square centimeters?



F. 72
G. 90
H. 108
J. 162
K. 201.5

PPF 602
MEA 601

15. If $x(x - 5) = 0$, then x is equal to:

A. 0 or −5.
B. 0 or 5.
C. −5 only.
D. 0 only.
E. 5 only.

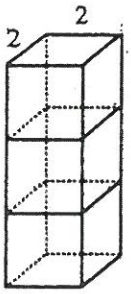
16. The sum of the measures of $\angle B$ and $\angle C$ is 180°, and $\angle A \cong \angle B$. What *must* be true about the measures of $\angle A$ and $\angle C$?

F. $m\angle A + m\angle C = 90°$
G. $m\angle A + m\angle C = 180°$
H. $m\angle A < m\angle C$
J. $m\angle A > m\angle C$
K. $m\angle A = m\angle C$

PPF 761

DO YOUR FIGURING HERE.

7. Three identical cubes with sides 2 inches long are placed one on top of the other as shown below. What is the volume, in cubic inches, of the resulting rectangular solid?



A. 48
B. 36
C. 24
D. 18
E. 12

MEA Gc1

18. What is the product of $2x - 1$ and $2x + 1$?

F. $4x$
G. $2x^2 - 1$
H. $4x^2 - 1$
J. $4x^2 + 1$
K. $4x^2 - 4x - 1$

19. To make walking less strenuous, a park administrator decides to reduce the grade (slope) of a walking path. At present, the walking path has a 10% grade. That is, the path rises 30 feet for every 300 feet of horizontal distance. The grade of the walking path would be reduced if the path rises:

A. 40 feet for every 300 feet of horizontal distance.
B. 35 feet for every 275 feet of horizontal distance.
C. 30 feet for every 250 feet of horizontal distance.
D. 25 feet for every 300 feet of horizontal distance.
E. 20 feet for every 200 feet of horizontal distance.

20. If $y = 2x + 3$ and $x = 3a - 5$, then y is equivalent to:

F. $3a - 2$
G. $6a - 2$
H. $6a - 7$
J. $6ax - 15$
K. $2x + 3a - 2$

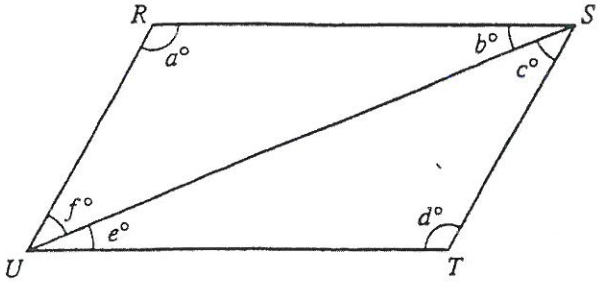
21. What is the value of P for the system of equations given below?

$$\begin{cases} P + Q = 24 \\ P + R = 22 \\ Q + R = 26 \end{cases}$$

A. 10
B. 12
C. 20
D. 24
E. 26

DO YOUR FIGURING HERE.

22. Which of the following conditions would force $\overline{RS}$ and $\overline{UT}$, shown below, to be parallel?



F. $b° = f°$
G. $b° = e°$
H. $c° = f°$
J. $a° + c° = 180°$
K. $a° + f° = 180°$

PPF 7G 1
PPF 5G 1

23. The length of a rectangle is 9 yards, and its perimeter is 20 yards. What is the ratio of the width of the rectangle to its length?

A. $\frac{1}{9}$
B. $\frac{20}{81}$
C. $\frac{9}{20}$
D. $\frac{9}{10}$
E. $\frac{20}{9}$

MEA 6G 1

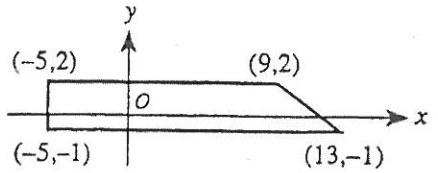
24. For nonzero x and y, the expression $\frac{9x^6y^4 - 12x^9}{3x^3}$ is equivalent to which of the following?

F. $3x^2y^4 - 12x^3$
G. $3x^2y^4 - 4x^3$
H. $3x^3y^4 - 4x^6$
J. $6x^3y^4 - 9x^6$
K. $-12x^9y^4$

25. At 8 A.M. on Monday, a bacteriologist cultures 10,000 bacteria of a certain species that typically doubles in number every 24 hours. From this information, what is the best prediction for the number of bacteria there will be at 8 A.M. on the following Sunday?

A. 70,000
B. 114,000
C. 130,000
D. 320,000
E. 640,000

26. What is the area, in square units, of the trapezoid shown below in the standard (x,y) coordinate plane?



F. 35
G. 40
H. 48
J. 54
K. 96

DO YOUR FIGURING HERE.

MEA 702
GRE 603

27. Phyllis is building a scale model of a sailboat. One of the sails of the actual boat is a right triangle with one leg 12 feet long and the other leg 5 feet long. If Phyllis wants the longer leg of this sail on her model to be 8 inches long, how many inches long should the other leg be?

A. 1

B. $1\frac{5}{8}$

C. $3\frac{1}{3}$

D. 5

E. $7\frac{1}{2}$

28. What is the midpoint of a line segment whose endpoints have coordinates (–5,3) and (15,–9) in the standard (x,y) coordinate plane?

F. (–2, 6)
G. (–1, 3)
H. (5,–3)
J. (10,–6)
K. (10, 6)

GRE 504

29. A land surveyor locates and flags 3 corners of a rectangular piece of property as shown in the figure below. She measures the distance from point C to point A as 100 ft and the distance from point C to point B as 50 ft. Which of the following equations will give $x°$, the measure of $\angle CAB$?

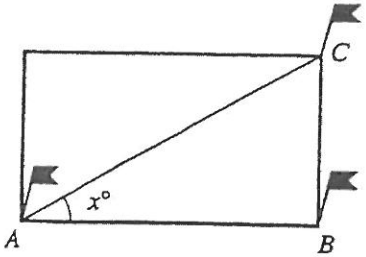
A. $\cos x° = \frac{50}{100}$

B. $\sin x° = \frac{50}{100}$

C. $\tan x° = \frac{50}{100}$

D. $\sin x° = \frac{100}{50}$

E. $\tan x° = \frac{100}{50}$



FUN 502

30. From the intersection of Highway 12 and County Road F, a person walks due south 4 kilometers and then turns 90° and walks due east an equal distance. Along the straight-line path, how many kilometers is the person from the original intersection?

DO YOUR FIGURING HERE.

PPF 602

F. $\frac{4}{\sqrt{2}}$

G. $4\sqrt{2}$

H. $4\sqrt{3}$

J. 8

K. $8\sqrt{2}$

31. A high school basketball team wins 20% of its first 15 games this season. Then, to complete the season, the team plays G more games and wins 80% of them. In terms of G, what fraction of its games did the team win for the entire season?

A. $\frac{0.8G}{15+G}$

B. $\frac{3+0.8G}{15+G}$

C. $\frac{3+0.8G}{G}$

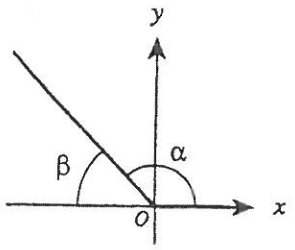
D. $\frac{3.8}{G}$

E. $\frac{1}{2}G$

32. The angle α, shown in the standard (x,y) coordinate plane below, is in *standard position* (that is, its vertex is at the origin and its initial side is the positive x-axis). The angle β is the *reference angle* for α (that is, the acute angle determined by the x-axis and the terminal side of α). What is the measure of the reference angle for an angle of 300° ?

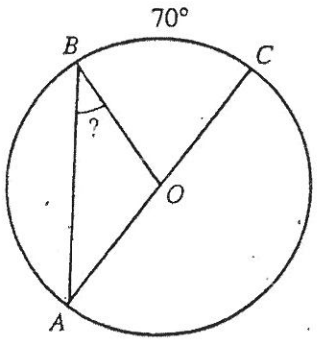
PPF 402

F. 30°
G. 60°
H. 120°
J. 150°
K. 300°



DO YOUR FIGURING HERE.

33. In the figure below, $\overline{AC}$ is a diameter of the circle centered at O. Point B is on the circle, and the measure of $\overset{\frown}{BC}$ is 70°. What is the measure of $\angle OBA$?



A. 30°
B. 35°
C. 45°
D. 60°
E. 70°

PPF 402
PPF 503

34. Under which of the following circumstances is the mean of the numbers 16, $8\frac{1}{2}$, $13\frac{1}{2}$, 12, and x exactly 10 ?

F. Only when $x = 0$

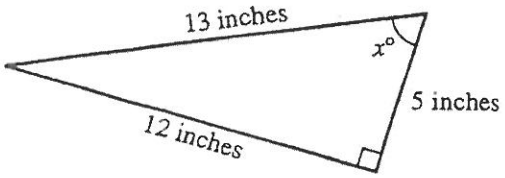
G. Only when $x = 7\frac{1}{2}$

H. Only when $x = 10$

J. Only when $x = 12\frac{1}{2}$

K. Whenever x is the same as one of the other numbers in the set

35. In the right triangle below, what is the value of $\cos x°$?



FUN 502

A. $\frac{5}{12}$

B. $\frac{5}{13}$

C. $\frac{12}{13}$

D. $\frac{13}{12}$

E. $\frac{13}{5}$

DO YOUR FIGURING HERE.

36. $A = \{2, 3, 5\}$; $B = \{2, 4, 6\}$; and $C = \{1, 2, 3, 4, 5, 6\}$. If a number is selected at random from the set C, what is the probability that the number selected will also belong to both A and B ?

F. $\frac{1}{6}$

G. $\frac{1}{3}$

H. $\frac{1}{2}$

J. $\frac{2}{3}$

K. $\frac{5}{6}$

37. Considering all pairs of real numbers m and n such that $|m| > |n|$ and $m < n$, which of the following statements about m *must* be true?

A. $m > 0$
B. $m = 0$
C. $m < 0$
D. $m > -n$
E. $m = -n$

38. If one side of a triangle is 10 inches long, which of the following could NOT be the lengths, in inches, of the other sides?

F. 2 and 9
G. 3 and 5
H. 5 and 10
J. 10 and 10
K. 10 and 12

DO YOUR FIGURING HERE.

Use the following information to answer questions 39–41.

Employees of Metro Merchandise sell merchandise by telephone. Employees are offered 2 different pay options. Option A offers employees \$5 per hour plus a commission equal to 10% of their sales. Option B offers \$8 per hour with no commission. Each employee must choose either Option A or Option B at the beginning of each pay period.

39. Todd, an employee of Metro Merchandise, worked for 4 hours and earned \$40 for the 4-hour period. What was the amount of his sales for the 4-hour period?

A. \$ 20
B. \$ 80
C. \$100
D. \$200
E. \$400

40. Under Option A, how much would an employee earn by working 15 hours and making sales totaling \$500 ?

F. \$ 55
G. \$ 65
H. \$ 85
J. \$125
K. \$575

41. Margo has been hired by Metro Merchandise and is trying to decide which pay option to choose. She asked 4 current employees how many hours they worked and how much merchandise they sold in the last pay period and tabulated the information as follows:

Employee	Hours	Sales
Andrea	10	\$404
Lee	12	\$350
Steve	11	\$326
Damon	7	\$200

From this table, she formed the matrix $M = \begin{bmatrix} 10 & 404 \\ 12 & 350 \\ 11 & 326 \\ 7 & 200 \end{bmatrix}$ that she wants to multiply by a matrix X so that the left column of the matrix product $M \cdot X$ will have the earnings of these employees under Option A and the right column will have their earnings under Option B. Which of the following matrices should she use for X ?

A. $\begin{bmatrix} 5 & 8 \\ 0 & 0.1 \end{bmatrix}$

B. $\begin{bmatrix} 5 & 0.1 \\ 8 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 5 & 8 \\ 0.1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 5 & 0 \\ 8 & 0.1 \end{bmatrix}$

E. $\begin{bmatrix} 8 & 5 \\ 0 & 0.1 \end{bmatrix}$

DO YOUR FIGURING HERE.

42. If $f(x) = x^2 + 3x - 1$ and $g(x) = x^3 - 3x + 2$, then $f(g(-1)) = ?$

F. −16
G. −12
H. −3
J. 4
K. 27

43. When the graph of $x^2 + y^2 = 16$ in the standard (x,y) coordinate plane is rotated about the y-axis, what 3-dimensional figure is generated?

A. A sphere with a radius of 16 units
B. A sphere with a radius of 8 units
C. A sphere with a radius of 4 units
D. An ellipsoid with foci at (−3,0) and (3,0)
E. An ellipsoid with foci at (−4,0) and (4,0)

44. Which of the following is an equation of the line that is both parallel to and equidistant from the lines with equations $y = 3x - 6$ and $y = 3x + 2$?

F. $y = 3x - 4$

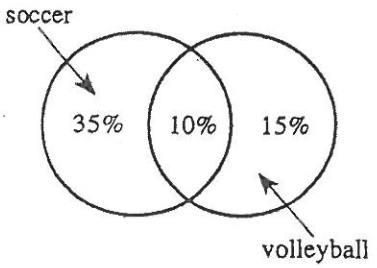
G. $y = 3x - 2$

H. $y = 3x + 4$

J. $y = \frac{3}{2}x - 3$

K. $y = \frac{3}{2}x - 2$

45. The intramural program at Ellington School has 300 students participating in one or more sports. The Venn diagram below indicates the percentages of these students who participate in soccer and/or volleyball. How many of the 300 students participate in neither soccer nor volleyball?



A. 75
B. 120
C. 135
D. 150
E. 180

DO YOUR FIGURING HERE.

46. The school bookstore pays its supplier \$7.50 for each T-shirt plus a shipping charge of \$20.00 for the entire T-shirt order. The bookstore will sell the T-shirts for \$10.00 each. What is the minimum number of T-shirts the bookstore must order and sell to make a profit of at least \$100 ?

F. 10
G. 14
H. 32
J. 40
K. 48

47. For all $x \neq 1$, $\frac{4}{1-x} + \frac{4}{x-1}$ is equivalent to which of the following?

A. 8

B. 4

C. 0

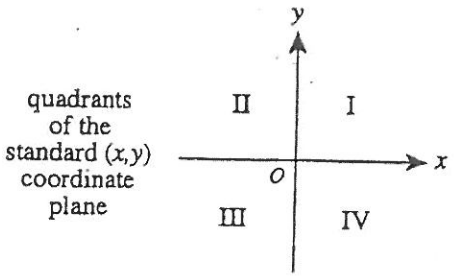
D. $\frac{8}{x-1}$

E. $\frac{8}{-x^2-1}$

48. For all values of θ, the expression $1 - \cos^2\theta$ simplifies to:

F. $\cot 2\theta$
G. $\tan 2\theta$
H. $\cot^2\theta$
J. $\tan^2\theta$
K. $\sin^2\theta$

49. The quadrants are labeled in the standard (x,y) coordinate plane below. The graph of $y - 1 > x^2$ has points in which quadrants?



A. Quadrants I and II only
B. Quadrants I and IV only
C. Quadrants II and III only
D. Quadrants III and IV only
E. Quadrants I, II, III, and IV

GRE 701

DO YOUR FIGURING HERE.

50. In a science class experiment, Charles measured the length of a spring after hanging each of several different weights from it. His data is recorded in the chart below.

Weight hung from spring, in grams x	Length of spring, in centimeters y
50	23
85	33.5
110	41

Based on Charles's experiment, which of the following equations best represents the linear relationship between the weight hung from the spring and the length of the spring?

F. $y = 0.3x + 8$
G. $y = 0.3x - 8$
H. $y = 0.3x - 27$
J. $y = 0.5x + 2$
K. $y = 0.5x - 2$

51. If k and n are integers greater than 1, and $k!$ is divisible by $n!$, then which of the following *must* be true?

(Note: $k! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot \cdots \cdot k$)

A. $k \geq n$
B. $k < n$
C. k is divisible by n
D. k and n have 1 as their only common factor
E. k and n have 1 and 2 as their only common factors

52. An equal number of nickels, dimes, and quarters in a cash register have a value of T cents. Which of the following is NOT always a divisor of T?

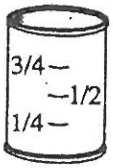
F. 40
G. 25
H. 20
J. 10
K. 5

53. The figure below shows Cup A, Mug B, and Container C. Container C has marks on its side to indicate various fractional capacities. Using Cup A, it takes 3 cupfuls of water to fill Container C to the $\frac{1}{2}$ mark. Then adding 1 mugful of water using Mug B raises the water level to the $\frac{3}{4}$ mark. Cup A can hold what fraction of the water that Mug B can hold?

A. $\frac{1}{12}$
B. $\frac{1}{3}$
C. $\frac{1}{2}$
D. $\frac{2}{3}$
E. $\frac{3}{4}$


Cup A


Mug B



Container C

DO YOUR FIGURING HERE.

GRE GCI

4. The graph, in the standard (x,y) coordinate plane, of which of the following lines contains the point $(5,0)$ and makes an angle of $45°$ with the positive x-axis?

F. $y + 10 = 2x$
G. $y = 45x$
H. $y = x + 5$
J. $y = x - 5$
K. $2y = 3x - 15$

55. Kevin was absent for the last civics test. For those who took the test, the mean score was 73.2, the median was 71, and the mode was 80. When Kevin took the test, his score was different from all the other students' scores and the class mean went down to exactly 73.0. What effect, if any, did Kevin's score have on the class mode?

A. None; the mode stayed the same.
B. It decreased the mode exactly 1 point.
C. It increased the mode exactly 1 point.
D. It increased the mode more than 1 point.
E. The effect of Kevin's score on the mode cannot be determined from the given information.

56. Which number is $\frac{1}{7}$ of the way from $\frac{1}{4}$ to $\frac{3}{5}$?

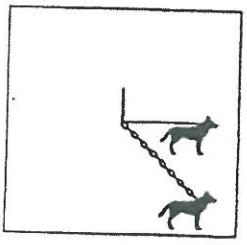
F. $\frac{1}{28}$
G. $\frac{11}{28}$
H. $\frac{7}{20}$
J. $\frac{3}{10}$
K. $\frac{2}{7}$

57. In the standard (x,y) coordinate plane, a way to produce the graph of $y = f(x - 3) + 4$ from the graph of $y = f(x)$ is to shift the graph of $y = f(x)$:

A. 3 units to the right and 4 units up.
B. 3 units to the left and 4 units up.
C. 4 units to the right and 3 units up.
D. 4 units to the right and 3 units down.
E. 4 units to the left and 3 units up.

58. Trisha ties her dog to a stake in her backyard by using either a chain or leash, as shown below. The chain allows the dog unobstructed movement for up to 20 feet from the stake in all directions. The leash allows the dog unobstructed movement for up to 15 feet from the stake in all directions. The dog's area of movement allowed by the chain is about how many square feet more than the area of movement allowed by the leash?

Trisha's backyard

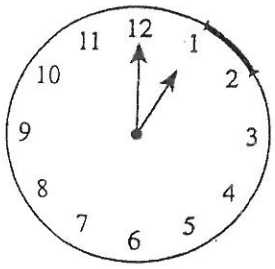


F. 5
G. 30
H. 80
J. 310
K. 550

MEA X2

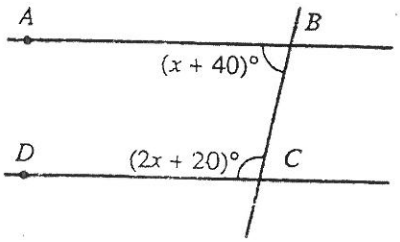
DO YOUR FIGURING HERE.

59. The arc between 2 consecutive numbers on a clock is highlighted in the figure below. Each minute, the hour hand of the clock moves through $\frac{1}{60}$ of such an arc. How many degrees does the hour hand move in 20 minutes?



A. 120
B. 60
C. 30
D. 20
E. 10

60. In the figure below, the measure of $\angle ABC$ is $(x + 40)°$ and the measure of $\angle BCD$ is $(2x + 20)°$. What are all the values of x such that the measures of $\angle ABC$ and $\angle BCD$ must be between 0° and 180° and $\overleftrightarrow{AB}$ is NOT parallel to $\overleftrightarrow{CD}$?



F. $x \neq 40$
G. $-40 < x < 140$
H. $-10 < x < 80$
J. $-40 < x < 40$ or $40 < x < 140$
K. $-10 < x < 40$ or $40 < x < 80$

PFF 701

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.